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PERIOD 7 & 8

SUB TOPIC: OPERATIONS ON SETS

SUBJECT : MATHEMATICS
CHAPTER NUMBER: 13
CHAPTER NAME :SET CONCEPTS

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LEARNING OUTCOME

Students will be able to define and differentiate

- union of sets.
- Intersection of sets
- Difference of sets.
- Cardinal properties of sets.
- Implement concepts in daily life situations.

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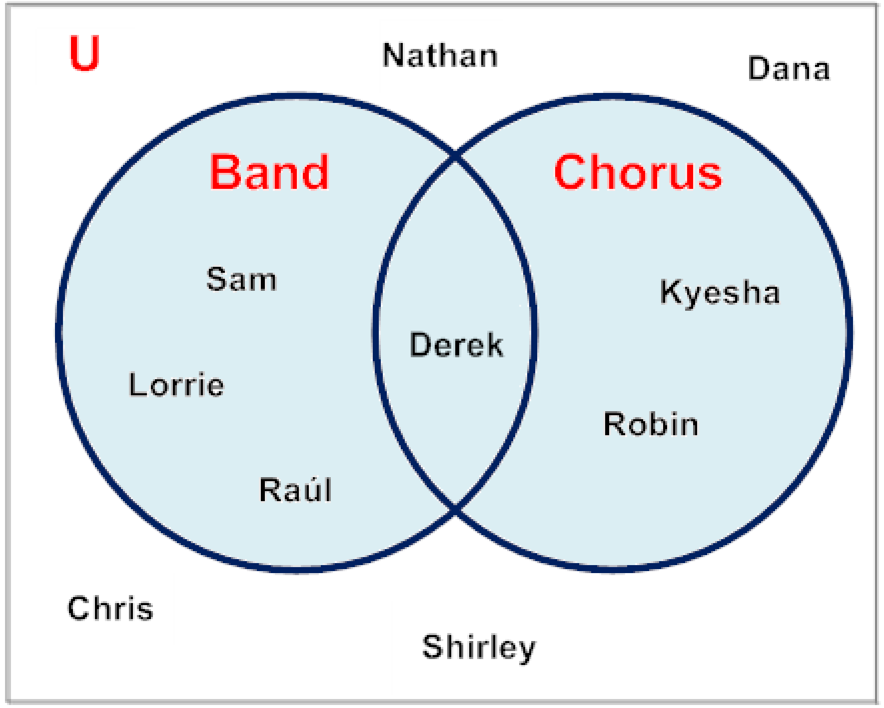
PREVIOUS CONNECT

- **Given A = {a, c}, B = {p, q, r} and C = Set of digits used to form number 1351.**
  Write all the subsets of sets A, B and C.

UNION OF SETS

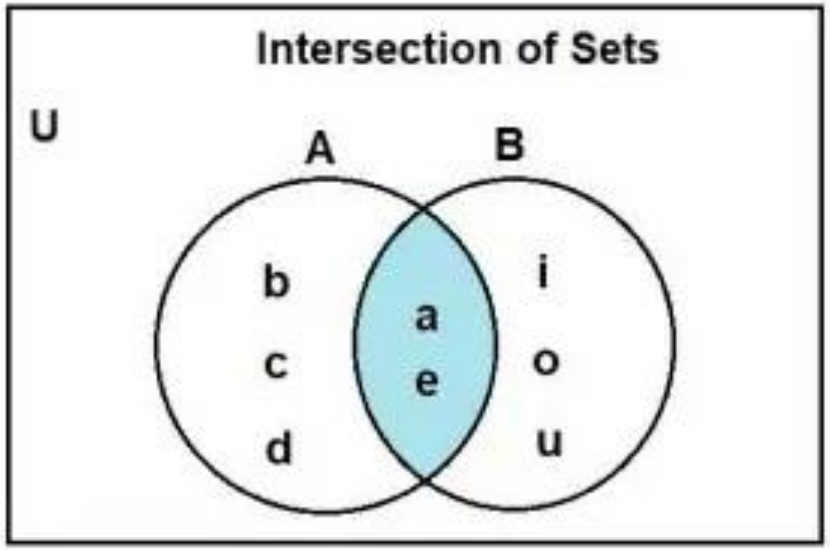


Definition: The **union** of two sets *A* and *B,* is the set of elements which are in *A* or in *B* or in both. It is denoted by ***A∪B,*** and is read "*A union B*".

INTERSECTION OF SETS

The intersection of A and B is the set of all those elements which belong to both A and B.

Now we will use the notation A ∩ B (which is read as 'A intersection B') to denote the intersection of set A and set B.



If A and B are two sets, then **their difference is given by A - B or B - A.**

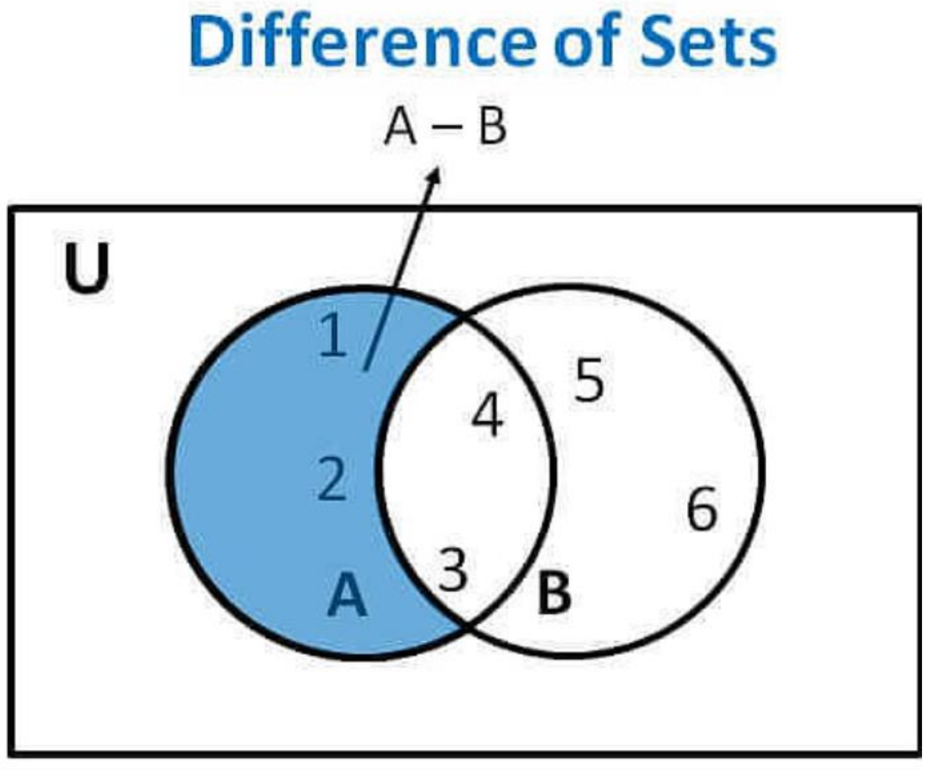
- If A = {2, 3, 4} and B = {4, 5, 6}

A - B means elements of A which are not the elements of B.

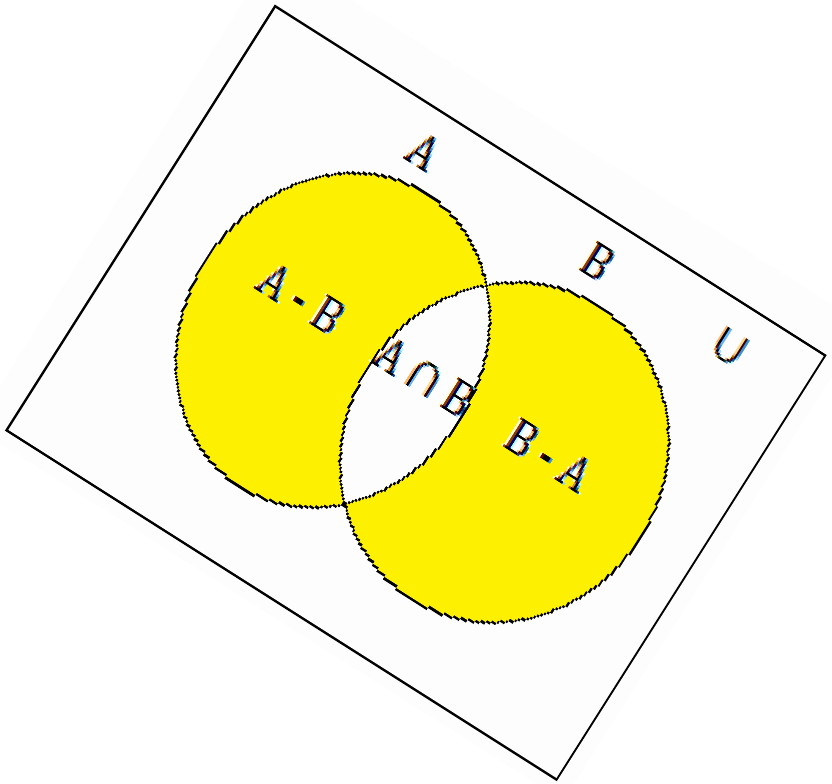
i.e., in the above example A - B = {2, 3}

In general, B - A = $\{x : x \in B, \text{ and } x \notin A\}$

- If A and B are disjoint sets, then A – B = A and B – A = B



CARDINAL PROPERTIES OF SETS



If A and B are finite sets,
then • $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

If $A \cap B = \phi$, then $n(A \cup B) = n(A) + n(B)$

It is also clear from the Venn diagram that • $n(A - B) = n(A) - n(A \cap B)$

• $n(B - A) = n(B) - n(A \cap B)$

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EVALUATION QUESTIONS

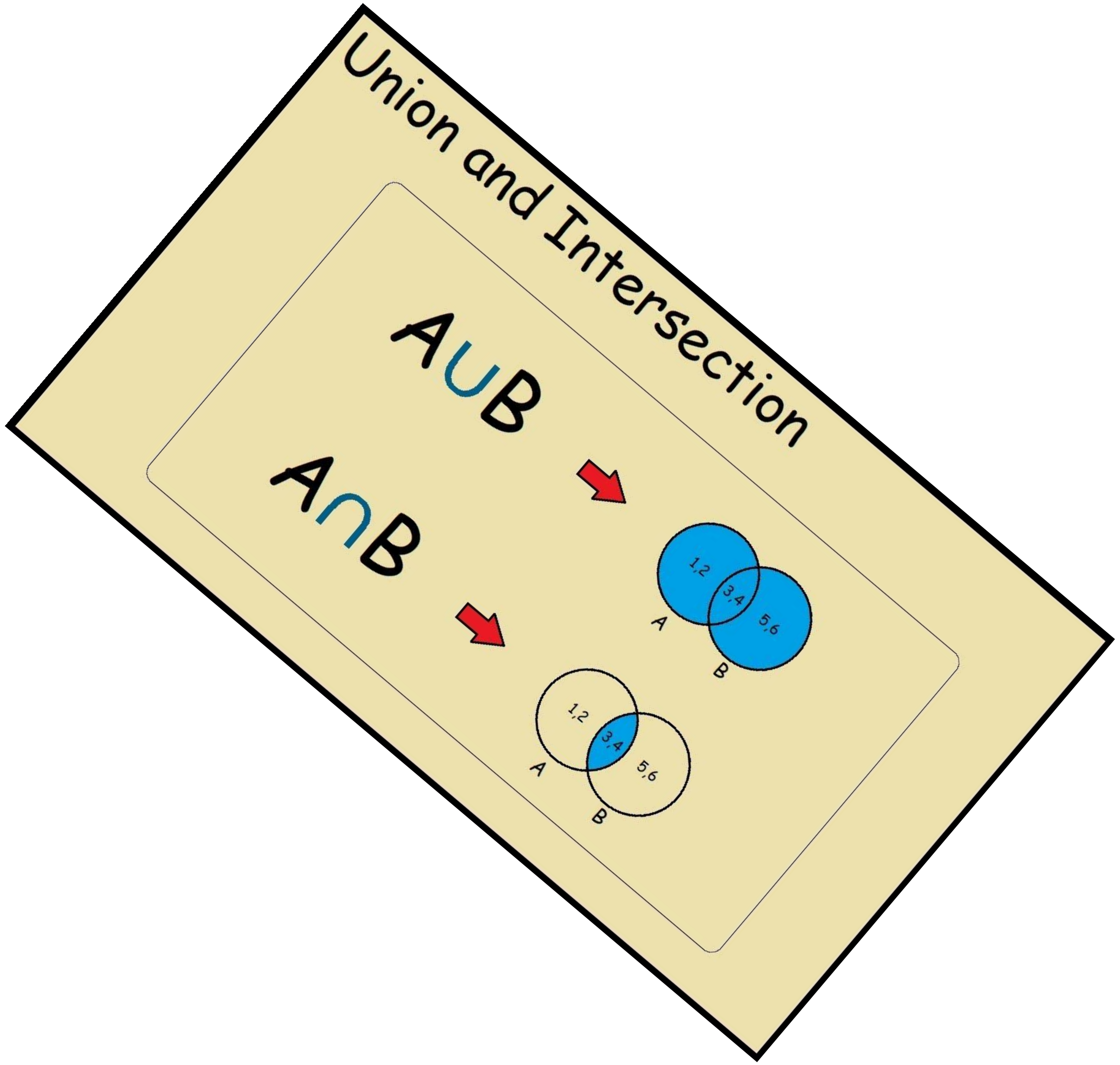
Exercise 13D page: 157

1. **If A = {4, 5, 6, 7, 8} and B = {6, 8, 10, 12}, find :**
   (i) A∪B

(ii) A∩B

(iii) A-B

(iv) B-A



Solution:

(i) $A \cup B$

$A \cup B$ = {All the elements from set A and all the elements from set B} = {4, 5, 6, 7, 8, 10, 12}

(ii) $A \cap B$

$A \cap B$ = {Elements which are common to both the sets A and B} = {6, 8}

(iii) A-B

A − B = {Elements of set A which are not in set B} = {4, 5, 7}

(iv) B-A

B − A = {Elements of set B which are not in set A} = {10, 12}

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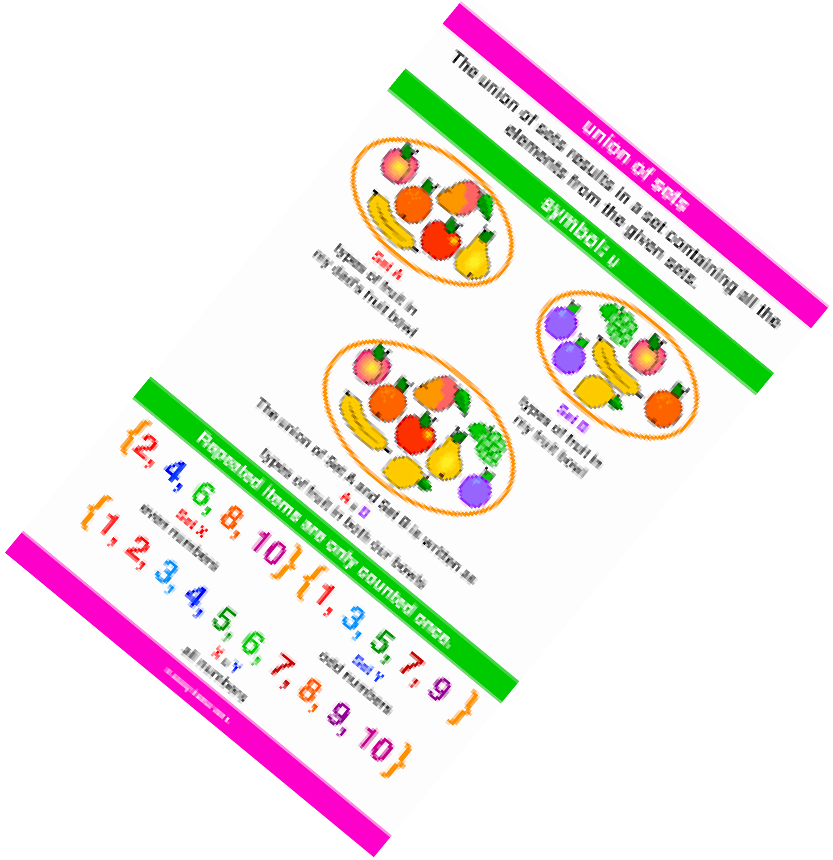
2. If A = {3, 5, 7, 9, 11} and B = {4, 7, 10}, find:

(i) n(A)

(ii) n(B)

(iii) A∪B and n(A∪B)

(iv) A∩B and n(A∩B)



Solution:

(i) n(A) = {3, 5, 7, 9, 11} = 5

(ii) n(B) = {4, 7, 10} = 3

(iii) A∪B = {3, 4, 5, 7, 9, 10, 11}

n(A∪B) = 7

(iv) A∩B = {7}

n(A∩B) = 1

3. If A = {2, 4, 6, 8} and B = {3, 6, 9, 12}, find:
(i) (A ∩ B) and n(A ∩ B)

(ii) (A – B) and n(A – B)

(iii) n(B)

Solution:

(i) (A ∩ B) = {6}

n(A ∩ B) = 1

(ii) (A – B) = {2, 4, 8}

n(A – B) = 3

(iii) n(B) = {3, 6, 9, 12} = 4

4. If P = {x : x is a factor of 12} and Q = {x: x is a factor of 16}, find :
(i) n(P)

(ii) n(Q)

(iii) Q – P and n(Q – P)

Solution:

(i) n(P) = Factors of 12 = 1, 2, 3, 4, 6, 12
n(P) = 6

(ii) n(Q) = Factors of 16 = 1, 2, 4, 8, 16
n(Q) = 5

(iii) Q – P and n(Q – P)
Elements of set P = {1, 2, 3, 4, 6, 12}
Elements of set Q = {1, 2, 4, 8, 16}
Q – P = {8, 16}
n (Q – P) = 2

5. M = {x : x is a natural number between 0 and 8) and N = {x : x is a natural number from 5 to 10}. Find:

(i) M – N and n(M – N)

(ii) N – M and n(N – M)

Solution:
We know that
Natural numbers between 0 and 8 M = {1, 2, 3, 4, 5, 6, 7}
Natural numbers from 5 to 10 N = {5, 6, 7, 8, 9, 10}
(i) M – N = {1, 2, 3, 4}
n(M – N) = 4
(ii) N – M = {8, 9, 10}
n(N – M) = 3

6. If A = {x: x is natural number divisible by 2 and x< 16} and B = {x: x is a whole number divisible by 3 and x < 18}, find :

(i) n(A)

(ii) n(B)

(iii) A∩B and n(A∩B)

(iv) n(A – B)

Solution:

$A = \{x: x \text{ is natural number divisible by 2 and } x < 16\} = \{2, 4, 6, 8, 10, 12, 14\}$

$B = \{x: x \text{ is a whole number divisible by 3 and } x < 18\} = \{3, 6, 9, 12, 15\}$

(i) $n(A) = 7$

(ii) $n(B) = 5$

(iii) $A \cap B = \{2, 4, 6, 8, 10, 12, 14\} \cap \{3, 6, 9, 12, 15\} = \{6, 12\}$

$n(A \cap B) = 2$

(iv)

$A - B = \{2, 4, 6, 8, 10, 12, 14\} - \{3, 6, 9, 12, 15\} = \{2, 4, 8, 10, 14\}$

$n(A - B) = 5$

7. Let A and B be two sets such that $n(A) = 75$, $M(B) = 65$ and $n(A \cap B) = 45$, find :

(i) $n(A \cup B)$

(ii) $n(A - B)$

(iii) $n(B - A)$

Solution:

It is given that

$n(A) = 75$, $M(B) = 65$ and $n(A \cap B) = 45$

(i) $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

Substituting the values

$n(A \cup B) = 75 + 65 - 45$

So we get

$n(A \cup B) = 95$

(ii) $n(A - B) = n(A) - n(A \cap B)$

Substituting the values

$n(A - B) = 75 - 45$

So we get

$n(A - B) = 30$

(iii) $n(B - A) = n(B) - n(A \cap B)$

Substituting the values

$n(B - A) = 65 - 45$

So we get

$n(B - A) = 20$

8. Let A and B be two sets such that $n(A) = 45$, $n(B) = 38$ and $n(A \cup B) = 70$, find :

(i) $n(A \cap B)$

(ii) $n(A-B)$

(iii) $n(B - A)$

Solution:

It is given that

$n(A) = 45$, $n(B) = 38$ and $n(A \cup B) = 70$

(i) $n(A \cap B) = n(A) + n(B) - n(A \cup B)$

Substituting the values

$n(A \cap B) = 45 + 38 - 70$

So we get

$n(A \cap B) = 13$

(ii) $n(A-B) = n(A \cup B) - n(B)$

Substituting the values

$n(A- B) = 70 - 38$

So we get

$n(A - B) = 32$

(iii) $n(B - A) = n(A \cup B) - n(A)$

Substituting the values

$n(B - A) = 70 - 45$

So we get

$n(B - A) = 25$

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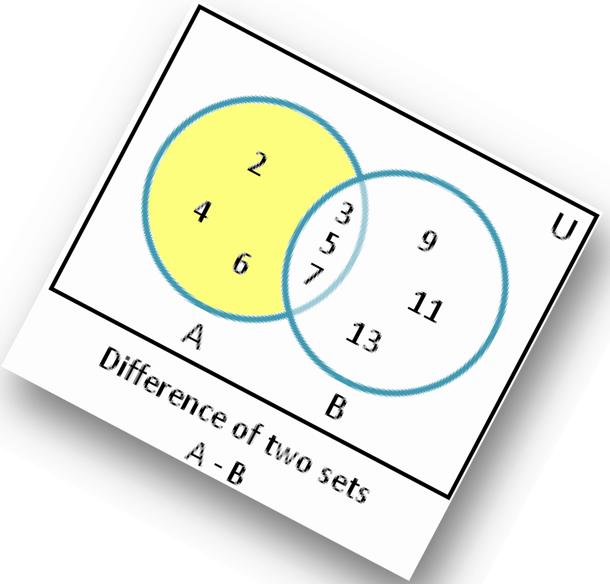
9. Let n(A) 30, n(B) = 27 and n(A∪B) = 45, find :
(i) n(A∩B)

(ii) n(A-B)



Solution:

n(A) = 30, n(B) = 27 and n(A∪B) = 45

(i) n(A∩B) = n(A) + n(B) − n(A∪B)

Substituting the values

n(A∩B) = 30 + 27 − 45

So we get

n(A∩B) = 12

(ii) n(A-B) = n(A∪B) − n(B)

Substituting the values

n(A-B) = 45 − 27

So we get

n(A-B) = 18

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10. Let $n(A) = 31$, $n(B) = 20$ and $n(A \cap B) = 6$, find:

(i) $n(A-B)$

(ii) $n(B - A)$

(iii) $n(A \cup B)$

Solution:

It is given that

$n(A) = 31, n(B) = 20$ and $n(A \cap B) = 6$

(i) $n(A\text{-}B) = n(A) - n(A \cap B)$

Substituting the values

$n(A\text{-}B) = 31 - 6$

So we get

$n(A\text{-}B) = 25$

(ii) $n(B - A) = n(B) - n(A \cap B)$

Substituting the values

$n(B - A) = 20 - 6$

So we get

$n(B - A) = 14$

(iii) $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

Substituting the values

$n(A \cup B) = 31 + 20 - 6$

So we get

$n(A \cup B) = 45$

HOMEWORK

- EX13 D
- Q.NO. 1to 5
- **AHA**
  There is a total of 200 students in class XI. 120 of them study mathematics, 50 students study commerce and 30students study both mathematics and commerce. Find the number of students who
- **i) Study mathematics but not commerce**
- **ii) Study commerce but not mathematics**
- **iii) Study mathematics or commerce**

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